

Four new species of *Myrsidea* Waterston chewing lice (Phthiraptera: Menoponidae) from the Malagasy warblers (Passeriformes)

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Abstract

Four new species of the menoponid genus *Myrsidea* Waterston are described from the Malagasy warblers. These new species and their type hosts are: *M. yoshizawai* ex the Short-billed tetraka, *Xanthomixis zosterops andapae* (Salomonsen); *M. goodmani* ex the Long-billed bernieria, *Bernieria madagascariensis madagascariensis* (J.F. Gmelin); *M. mccrackeni* ex the White-throated oxylabes, *Oxylabes madagascariensis* (J.F. Gmelin); and *M. batesi* ex the Long-billed bernieria, *B. m. madagascariensis* (J.F. Gmelin). These represent the first species of *Myrsidea* to be described from this group of hosts. We also sequenced a portion of the mitochondrial COI gene for these and other species of *Myrsidea*.

Key words: chewing lice, *Myrsidea*, Phthiraptera, Menoponidae, Madagascar

Introduction

The genus *Myrsidea* Waterston currently contains 272 recognized species of chewing lice, with 260 of these recorded from hosts within the order Passeriformes, 9 from the Piciformes, and 3 from the Apodiformes (see Price *et al.* 2003, Johnson and Price 2006, Price and Dagleish 2006, Sychra *et al.* 2006). In our continuing work on the taxonomy of *Myrsidea*, we have found that species of lice are confined to individual host families, and that treating *Myrsidea* by host family units is the only practical way to deal with this genus. However, this approach requires accurate avian taxonomies. The Malagasy warblers are a group of songbirds (Passeriformes) formerly classified into three separate families because of large morphological disparities. However, recent work has shown this to be an endemic radiation of songbirds on Madagascar (Cibois *et al.* 1999, 2001). This group of Malagasy endemics is probably most closely related to the megalurine warblers

of Africa (Beresford *et al.* 2005). The taxonomic status of some Old World passerine families is still in a state of flux, but it appears clear that these Malagasy warblers form a monophyletic group distinct from other Old World songbird families. We recently obtained a limited number of *Myrsidea* specimens from these Malagasy warblers. There have been no *Myrsidea* described previously from these birds, and it is our purpose to describe and illustrate these as new species here.

We also sequenced a portion of the mitochondrial cytochrome oxidase I (COI) gene for these lice and other species of *Myrsidea* to evaluate the genetic distinctiveness of these species and their phylogenetic relationships.

For the following descriptions, all measurements were made with an ocular micrometer and are given in millimeters. Abbreviations for dimensions are: TW, temple width; HL, head length at midline; PW, prothorax width; MW, metathorax width; AWIV, abdomen width at segment IV; ANW, female anus width; GL, male genitalia length; TL, total length. The host nomenclature below that of family follows Dickinson (2003). The holotypes are deposited in The Field Museum, Chicago, IL; paratypes are distributed between that collection and that of the Illinois Natural History Survey, Champaign, IL.

Genus *Myrsidea* Waterston

Myrsidea Waterston 1915: 12. Type species: *Myrsidea victrix* Waterston by original designation.

A brief characterization of this genus as it pertains to the features shared in common by the Malagasy warbler lice in this study is as follows. Head as in Fig. 1; evenly rounded anteriorly; no lateral notch or slit; inner occipital setae much longer than minute outer setae; no ventral sclerotized processes; gula with heavier longer posterior seta on each side; hypopharyngeal sclerites strongly developed. Thorax (Fig. 1) with pronotum having 6 long posterior setae; no central setae; and 3 short setae at each lateral angle. Mesonotum with 2 minute medioanterior setae adjacent to postnotum and 2 at posterior margin. Metanotum without central setae; with 6 short lateral and anterior setae, and very long (0.25–0.30) posterior corner seta. Prosternal plate well developed, elongate, with 2 short anterior setae; metasternal plate large, diamond shaped, with 4 setae; venter of femur III with setal brush.

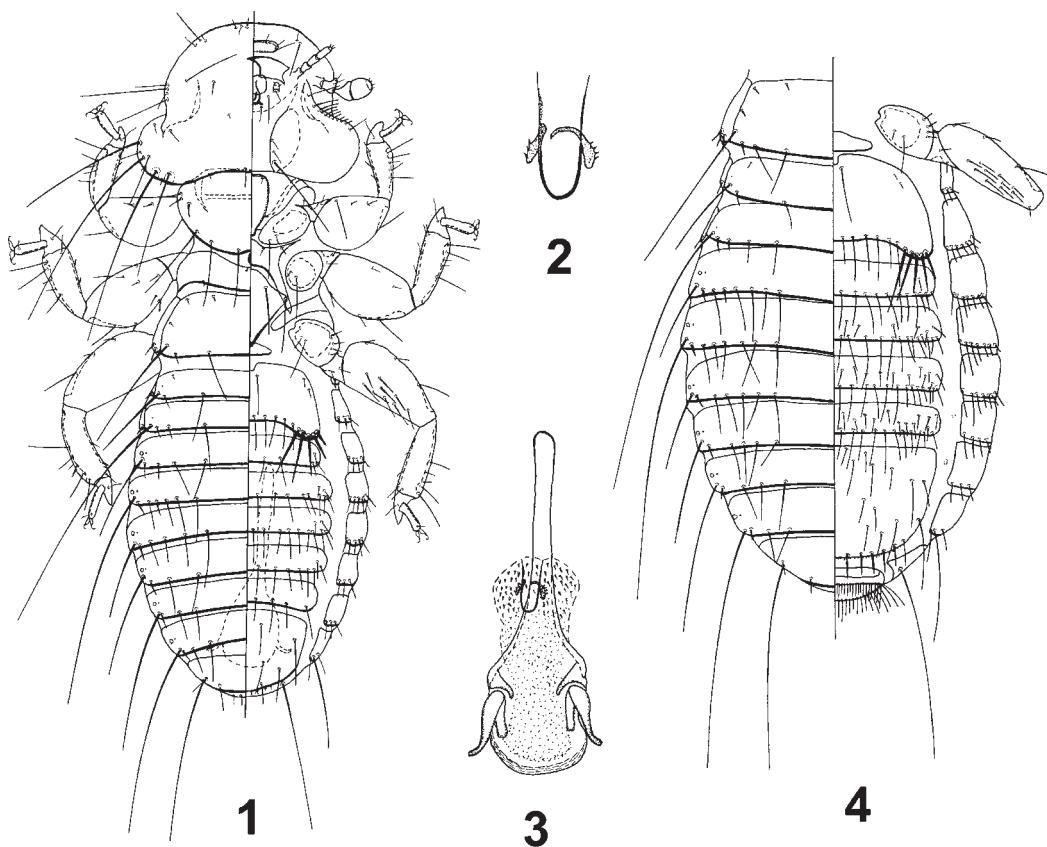
Abdomen (Figs. 1, 4, 6–7) with undivided tergites; no anterior setae except very small corner seta on each side of tergite I; postspiracular setae extremely long on tergites II, IV, and VIII (tergal setal counts include postspiracular setae and all setae between them); sternite I small, without setae; sternite II enlarged, with aster of heavy setae at each lateroposterior corner. Pleurites without anterior setae. Male subgenital plate of fused sternites VIII–IX; setae given for VIII represent those anteriorly located in region of segment VIII; genitalia of characteristic shape (Fig. 3), with spinous sac having associated sclerites (Figs. 2, 5). Female anus oval, without inner setae; subgenital plate of fused

sternites VII–IX, with serrated posterior margin; setae given for VII represent those anteriorly located in region of segment VII and those for VIII–IX are on the remainder of the plate. For brevity, these characters are not repeated in discussing each species.

***Myrsidea yoshizawai* Price and Johnson, new species (Figs. 1–4)**

Type host. *Xanthomixis zosterops andapae* (Salomonsen), the Short-billed tetraka.

Male. As in Fig. 1. Gula with 3 setae on each side. Metanotum with 6–8 setae on posterior margin. Tergal setae: I, 6; II, 8–9; III, 10–14; IV, 13–14; V, 11–13; VI, 9–12; VII, 8–10; VIII, 8. Conspicuous median gap in each tergal setal row. Postspiracular setae shortest (0.16–0.22) on I, III, and V, longer (0.23–0.27) on VI–VII, and extremely long (at least 0.40) on II, IV, and VIII. Sternal setae: II, each aster of 5 setae, remainder with 16–18; III, 10–11; IV, 18–20; V, 21–23; VI, 16–19; VII, 9–11; VIII, 4. Genitalia (Fig. 3) with elongate U-shaped sac sclerite as in Fig. 2. Dimensions: TW, 0.38–0.39; HL, 0.26–0.28; PW, 0.24; MW, 0.33–0.34; AWIV, 0.42–0.43; GL, 0.34–0.36; TL, 1.13–1.15.



FIGURES 1–4. *Myrsidea yoshizawai*. 1, Entire dorsoventral male. 2, Male genital sac sclerite. 3, Male genitalia. 4, Female metanotum and dorsoventral abdomen.

Female. Metanotum and abdomen as in Fig. 4. Metanotum with 8 setae on posterior margin. Tergites unmodified, of similar size. Tergal setae: I, 6; II, 11; III–V, 15–16; VI, 11; VII, 9; VIII, 8. With conspicuous median gap in each tergal setal row. Postspiracular setae as for male. Sternal setae: II, each aster of 5 setae, remainder with 19; III, 23; IV, 38; V, 47; VI, 44; VII, 15; VIII–IX with 12 marginal, 12 anterior setae. Each pleurite II–V with about 8 short marginal setae. Anus with 37 ventral fringe setae, 30 dorsal. Dimensions: TW, 0.44; HL, 0.30; PW, 0.28; MW, 0.42; AWIV, 0.56; ANW, 0.18; TL, 1.48.

Type material. Holotype female, ex *X. zosterops andapae*, **MADAGASCAR**: Antsiranana, Parc National de Marojejy, 19 Oct 2001, S. Goodman, SMG 12196. Paratypes: 2 males, same data as holotype.

Other material. 1 male, probably ex *X. zosterops andapae*, **MADAGASCAR**, but contaminant mounted on slide with louse ex *Philepitta castanea* (Statius Müller).

Remarks. This new species is recognized by the quantitative abdominal chaetotaxy, the conspicuous median gap in all tergal setae rows, and the male with the unique U-shaped genital sac sclerite.

The single "contaminant" male is clearly a member of this new species and is markedly different from males of *M. minuscula* (Piaget), the usual louse on *Philepitta castanea*. This slide carried the same locality data as for *X. zosterops andapae*, including S. Goodman the collector and the date of 16 Oct 2001.

Etymology. This species is named for Kazunori Yoshizawa, University of Hokkaido, Sapporo, in recognition of his contributions to understanding the phylogenetic relationships of parasitic lice and bark lice.

Myrsidea goodmani Price and Johnson, new species (Fig. 5)

Type host. *Bernieria madagascariensis madagascariensis* (J.F. Gmelin), the Long-billed bernieria.

Male. Gula with 2–3 setae on each side. Metanotum with 6 setae on posterior margin. Tergal setae: I, 6; II, 9; III–IV, 12; V, 11; VI, 10; VII–VIII, 8. Conspicuous median gap in each tergal setal row. Postspiracular setae extremely long (0.40 or more) on tergites II, IV, and VIII, shorter (0.25–0.29) on VI–VII, and shortest (0.13–0.22) on I, III, and V. Sternal setae: II, each aster with 5 setae, remainder with 23; III, 10; IV, 18; V–VI, 20–21; VII, 13; VIII, 4. Genitalia much as in Fig. 3, but with broad sac sclerite as in Fig. 5. Dimensions: TW, 0.39; HL, 0.28; PW, 0.24; MW, 0.36; AWIV, 0.45; GL, 0.37; TL, 1.14.

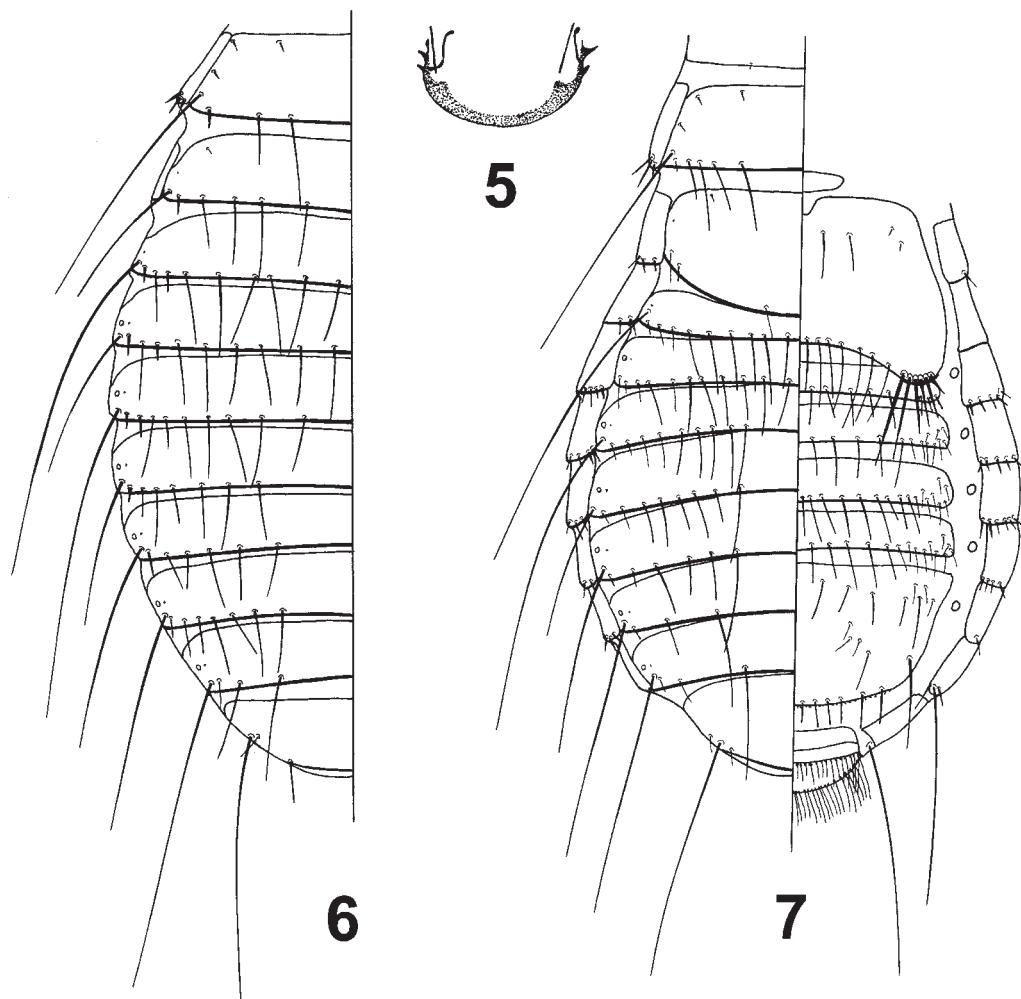
Female. Gula with 3–4 setae on each side. Metanotum with 8 setae on posterior margin. Tergites unmodified, of similar size. Tergal setae: I, 6; II, 12; III–V, 15–16; VI, 14; VII, 13; VIII, 8. Conspicuous median gap in each tergal setal row. Postspiracular setae as for male. Sternal setae: II, each aster with 5–6 setae, remainder with 21; III, 26; IV, 40; V–VI, 47–48; VII, 21; VIII–IX with 14 marginal, 13 anterior setae. Each pleurite II–V with 8–10 short marginal setae. Anus with 31–32 ventral and dorsal fringe setae.

Dimensions: TW, 0.45; HL, 0.30; PW, 0.29; MW, 0.40; AWIV, 0.59; ANW, 0.19; TL, 1.53.

Type material. Holotype female, ex *B. m. madagascariensis*, **MADAGASCAR**: Antsiranana, Parc National de Marojejy, 15 Oct 2001, S. Goodman, SMG 12152. Paratype: 1 male, same data as holotype except 26 Oct 2001, SMG 12250.

Remarks. This species is quite similar to *M. yoshizawai*, with only minor and likely not significant differences in setal numbers and dimensions. The two species are, however, separated on the basis of the male of *M. goodmani* having a quite different structure of the genital sac sclerite (Fig. 5 vs Fig. 2).

Etymology. This species is named for Steve Goodman, The Field Museum, Chicago, in recognition of his assistance in collecting the lice used for this study and for his continued efforts to preserve the Malagasy fauna.



FIGURES 5–7. 5, *Myrsidea goodmani*, male genital sac sclerite. 6, *M. mccrackeni*, female metanotum and dorsal abdomen. 7, *M. batesi*, female metanotum and dorsoventral abdomen.

***Myrsidea mccrackeni* Price and Johnson, new species (Fig. 6)**

Type host. *Oxylabes madagascariensis* (J.F. Gmelin), the White-throated oxylabes.

Male. Gula with 4 setae on each side. Metanotum with 7 setae on posterior margin. Tergal setae: I, 6; II–IV, 11–12; V, 13; VI–VII, 11; VIII, 9. Conspicuous median gap in each tergal setae row. Postspiracular setae extremely long (0.36 or more) on tergites II, IV, and VIII, shorter (0.27–0.31) on VI–VII, and shortest (not >0.19) on I, III, and V. Sternal setae: II, each aster with 5 setae, remainder with 21; III, 15; IV–V, 21–22; VI, 25; VII, 11; VIII, 4. Genitalia similar to Fig. 3, but without detectable sac sclerite. Dimensions: TW, 0.39; HL, 0.27; PW, 0.27; MW, 0.36; AWIV, 0.53; GL, 0.44; TL, 1.29.

Female. Gula with 4 setae on each side. Metanotum and dorsal abdomen as in Fig. 6. Metanotum with 8 setae on posterior margin. Tergites unmodified, of similar size. Tergal setae: I, 12; II–IV, 18–20; V–VI, 14–17; VII, 13–16; VIII, 8. Without conspicuous median gap in each tergal setal row on anterior segments II–III or II–IV. Postspiracular setae as for male. Sternal setae: II, each aster with 6–7 setae, remainder with 24–25; III, 18; IV, 35–38; V, 41–42; VI, 36–40; VII, 18–20; VIII–IX with 11–12 marginal, 12–13 anterior setae. Each pleurite II–V with 9–11 short marginal setae. Anus with 30–35 ventral and dorsal fringe setae. Dimensions: TW, 0.44–0.46; HL, 0.29–0.31; PW, 0.29; MW, 0.42–0.46; AWIV, 0.65; ANW, 0.23; TL, 1.58–1.66.

Type material. Holotype female, ex *O. madagascariensis*, **MADAGASCAR**: Antsiranana, Parc National de Marojejy, 24 Oct 2001, S. Goodman, SMG 12229. Paratypes: 1 male, 1 female, same data as holotype.

Remarks. The larger number of female abdominal tergal setae, especially on segments II–III, and the lack of a median gap in the tergal setal rows on these anterior segments enable easy recognition of this species as apart from the first two. In addition, both sexes have the gula with four setae on each side and a greater total length, and the female has a wider anus.

Etymology. This species is named for Kevin McCracken, University of Alaska, Fairbanks, in recognition of his assistance in collecting lice from a wide variety of birds.

***Myrsidea batesi* Price and Johnson, new species (Fig. 7)**

Type host. *Bernieria madagascariensis madagascariensis* (J.F. Gmelin), the Long-billed bernieria.

Male. Unknown.

Female. Gula with 3–4 setae on each side. Metanotum and abdomen as in Fig. 7. Metanotum with 11–12 setae on posterior margin. Tergite I enlarged, with broadly rounded posterior margin; remainder of segments with sizes as illustrated. Tergal setae: I, 6; II–IV, 18–23; V, 16–18; VI, 13–14; VII, 8–9; VIII, 7–8. With conspicuous median gap in each tergal setal row limited to segments IV–VIII. Postspiracular setae extremely short

(0.04–0.06) on I and III, extremely long (>0.35) on II, IV, VII–VIII, and intermediate in length (0.19–0.30) on V–VI. Sternal setae: II, each aster with 6 setae, remainder with 23; III, 16–17; IV, 28–32; V, 36–39; VI, 30–33; VII, 16–18; VIII–IX with 11–12 marginal, 10–13 anterior setae. Each pleurite II with only 2 short marginal setae, III–V with 7–10. Anus with 32–37 ventral and dorsal fringe setae. Dimensions: TW, 0.46–0.47; HL, 0.31–0.32; PW, 0.29–0.31; MW, 0.48; AWIV, 0.64–0.65; ANW, 0.22–0.23; TL, 1.60–1.61.

Type material. Holotype female, ex *B. m. madagascariensis*, **MADAGASCAR**: Fianarantsoa, Mt. Ambatobe, 23°30' S, 47°2' E, 13 Nov 2003, D. Willard, DW 5572. Paratype: 1 female, same data as holotype.

Remarks. This species is quite different in a number of aspects from those shown by the first three new species described above. Even though *M. batesi* is from the same subspecies of *B. madagascariensis* as *M. goodmani*, these two lice are from different localities and the populations of birds between these localities show a deep genetic subdivision between them (J. Bates, pers. comm.). These two louse species differ in major aspects involving the tergal development and the associated chaetotaxy. Even in the absence of males, *M. batesi* is so profoundly distinctive as to make it without doubt a new species.

Etymology. This species is named for John Bates, The Field Museum, Chicago, in recognition of his assistance in understanding genetic differentiation in the Malagasy birds in this paper as well as collecting lice from a wide variety of birds.

Discussion

While there are not profound morphological differences among the first three of these new species described here, the male genital sac sclerite clearly separates *M. yoshizawai* from *M. goodmani* and the large number and distribution of female tergal setae on abdominal segments II–III distinguish *M. mccrackeni* from both of the others. The fourth new species, *M. batesi*, is markedly different from the others by the combination of its enlarged and posteriorly rounded tergite I, the unusually short postspiracular setae on I and III, only two marginal setae on each pleurite II, and a median gap in the tergal setal rows limited to segments IV–VIII.

Results from a 379 base pair portion of the mitochondrial COI gene (GenBank accession numbers DQ860181-4) support our taxonomic findings. For the Malagasy warbler *Myrsidea* treated here, uncorrected percent sequence divergences range from 10.7% between *M. goodmani* and *M. batesi* to 21.1% between *M. goodmani* and *M. mccrackeni*. These values are very similar to divergences reported between other described species of *Myrsidea* (Johnson and Price 2006). The relatively lower sequence divergence between *M. goodmani* and *M. batesi* may be somewhat surprising given their morphological disparity. However, this level of divergence mirrors a similar genetic divergence between the same populations of the host, *Berniera madagascariensis* (J. Bates,

pers. comm.).

Phylogenetic analyses of these sequences with those of other species of *Myrsidea* (Fig. 8) indicate that the species of *Myrsidea* from Malagasy warblers form a monophyletic group that may mirror the fact that these birds form a monophyletic group. Given that there are at least six other species in this radiation of birds (Cibois *et al.* 2001), there are likely more species of *Myrsidea* remaining to be discovered from the Malagasy warblers.

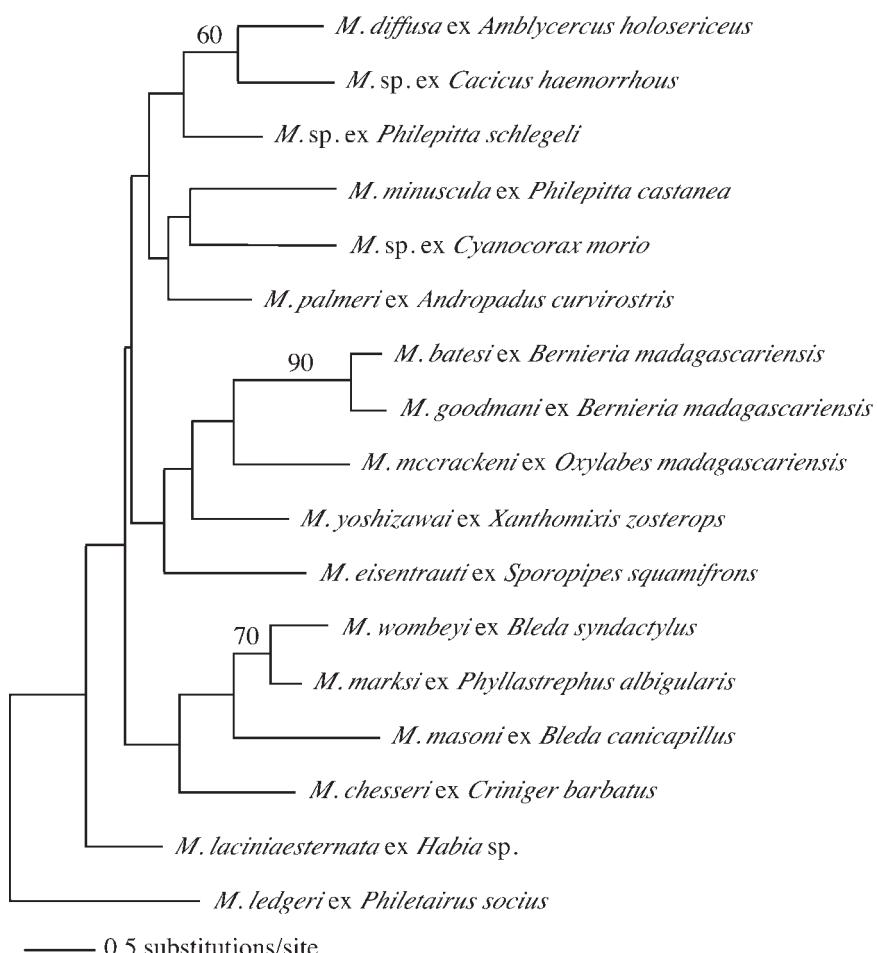


FIGURE 8. Phylogenetic tree based on maximum likelihood analysis of a 379 base pair portion of the mitochondrial COI gene. Searches involved 10 random addition replicates using a GTR + I + G model. Numbers above branches are support from 100 likelihood bootstrap replicates (only values > 50% shown). Branches proportional to substitutions per site (scale indicated). *M.* = *Myrsidea*.

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